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ABSTRACT

Despite the fact that more adolescents use alcohol than any other drug, studies of teenage alcohol misuse are relatively rare. This gap is addressed in this research report which examines the prevalence and demographic predictors of teenage alcohol misuse in a diverse sample of 4,390 high school seniors and dropouts. It focuses on three different dimensions of misuse: high-risk drinking, alcohol-related problems, and high consumption, and provides prevalence estimates by gender and race/ethnicity that are weighted to represent the original seventh-grade cohort of 30 California and Oregon schools. Research findings indicate that by grade 12, nearly 70% of the teenagers exhibited some form of alcohol misuse within the past year. Two-thirds engaged in high-risk drinking and over half have experienced one or more alcohol-related problems. More stringent estimates that require variety or persistence of risky drinking and/or alcohol-related problems still capture between 40% and 54% of this population, but this approach fails to identify as many as half of these at-risk misusers. Males and females both exhibit high rates of alcohol misuse, as do most racial ethnic groups. However, African Americans and Asians are less likely to misuse alcohol than Whites and Hispanics. The results underscore the need for including different forms of alcohol misuse in prevention programs. (RJM)

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Drugs, Alcohol, and Mental Health

RESEARCH REPORT

Teenagers and alcohol misuse in the United States: by any definition, it's a big problem

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Abstract

Despite the fact that more adolescents use alcohol than any other drug, studies of teenage alcohol misuse are relatively rare. Those that exist frequently fail to include high school dropouts and often focus on only part of the problem, such as how much or how often the adolescent drinks. This study examines the prevalence and demographic predictors of teenage alcohol misuse in a diverse sample of 4390 high school seniors and dropouts. It focuses on three different dimensions of misuse—high-risk drinking, alcohol-related problems and high consumption—and provides prevalence estimates by gender and race/ethnicity that are weighted to represent the original seventh grade cohort of 30 California and Oregon schools. Results show that by grade 12, nearly 70% of these teenagers have exhibited some form of alcohol misuse within the past year. Two-thirds have engaged in high-risk drinking and over 50% have experienced one or more alcohol-related problems. More stringent estimates that require variety or persistence of risky drinking and/or alcohol-related problems still capture between 40% and 54% of this population. However, focusing solely on high consumption fails to identify as many as half of these at-risk misusers. Males and females both exhibit high rates of alcohol misuse, as do most racial ethnic groups. However, African Americans and Asians are less likely to misuse alcohol than whites and Hispanics. The results underscore the need for including different forms of alcohol misuse in prevention programs, for improving our understanding of its etiology, and for providing upper and lower bound estimates of alcohol misuse in future research.

Introduction

Although preventing drug-related harms has long been the focus of many European countries, recent American efforts have put comparatively greater stress on preventing initiation and decreasing overall use (ONDCP, 1989). This strategy has yielded substantial reductions in occasional use of illicit drugs, but it has had minimal impact on alcohol use. By the time they are seniors, nearly 90% of American high school students have tried alcohol, over 50% are current users and about 28% have recently engaged in binge drinking (Johnston, O'Malley & Bachman, 1993a). Among adults, social drinking is both prevalent and widely accepted.

Where societal norms overwhelmingly support some use, the barriers to successful prevention of alcohol initiation or occasional drinking are high. Thus it is not surprising that several studies of school-based programs have had little or no success in curbing how much or how often young people drink (Hansen, Malotte & Fielding, 1988; Dielman *et al.*, 1989; Moskowitz, 1989; Ellickson & Bell, 1990; Johnson *et al.*, 1990).

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However, somewhat better results have been reported for problematic use, at least among high-risk youth. One study, which had no impact on the quantity or frequency of drinking, did find reductions in alcohol misuse among 6th graders who had already engaged in unsupervised drinking (Dielman *et al.*, 1989).

These results suggest that curbing alcohol misuse may be a more attainable goal than preventing any or occasional use. It may also be a more efficient route to preventing the harms associated with drinking. If we want to give more attention to preventing alcohol misuse, however, we need to develop a better understanding of what constitutes misuse among young people—what the dimensions of alcohol misuse are, how they are or are not interrelated, and how prevalent different types of misuse are among adolescents with different social and demographic backgrounds.

Despite the fact that more adolescents use alcohol than any other drug, studies of teenage alcohol misuse are relatively rare (Weber *et al.*, 1989). Those that exist typically fail to include high school dropouts (Johnston *et al.*, 1993b; Kann *et al.*, 1993), a practice that can lead to underestimation of the problem (Pirie, Luepker & Murray, 1988). They also use varying definitions of misuse, reflecting the fact that little consensus exists about what constitutes misuse among young people.

This lack of consensus reflects developmental differences between adolescents and adults and between younger and older adolescents. For example, recent research has shown that some drinking styles, such as convivial drinking, are associated with alcohol-related problems among adolescents and younger adults but not among older adults (Kilty, 1990). Drinking levels that may cause little or no problem for adults can be dangerous for adolescents, who typically differ from adults in body weight, drinking experience and judgement. Their coordination, reflexes and thinking may be negatively affected by one or two drinks; they frequently lack experience in judging how alcohol affects them; and they may misinterpret prior experience or label specific situations as harmless when they are not. Although adults may do all of these things as well, our society deems that adolescents, who are still "in process" developmentally, require greater protection from the consequences of poor decision making.

In addition, adolescent patterns of alcohol use rarely approximate those of adult problem drinkers. Addiction is rare among adolescents, and measures of dependency or problem drinking that are typically used for older people do not capture drinking patterns that pose serious threats to adolescents (White & LaBouvie, 1989). Many young people whose drinking entails harmful consequences do not meet the high tolerance or pathological criteria contained in clinical definitions of alcohol disorder (e.g. craving, inability to control drinking, blackouts, etc.). For example, less than 4% of the high school seniors in the sample described in this paper said they had wanted to stop drinking but could not, whereas 24% had passed out because of drinking in the past year. Many adolescents who engage in high-risk patterns of drinking (binge drinking, polydrug use) do not drink regularly.

Quantity/frequency indices also have different meanings for adults and adolescents. The latter typically drink less often than adults, but consume larger amounts when they drink (Harford & Mills, 1978). Although nearly 30% of high school seniors have participated in recent bouts of binge drinking, very few (only 3%) are daily drinkers (Johnston *et al.*, 1993a). Thus we need to recognize that quantity-frequency indices for adolescents may be dominated by infrequent consumption of high quantities (Harford & Spiegler, 1983).

For these reasons, it is important to take into account multiple indicators of alcohol misuse among teenagers. This paper examines three dimensions of alcohol misuse—high-risk drinking, drinking that results in negative consequences and quantity/frequency indices that yield different measures of high consumption. Using data from a diverse sample of 4390 high school seniors and dropouts, it asks how prevalent alcohol misuse is among young people, which kinds of misuse are most and least common, and how the different dimensions are related. It also asks whether some ethnic and demographic groups are more vulnerable to misusing alcohol than others and whether "group vulnerabilities" vary with the definition of misuse.

Method

Subjects

Subjects included 4390 members of a longitudinal panel originally drawn from 30 California and Oregon middle schools. The schools, deliberately chosen to reflect a wide range of school

and community environments, encompassed urban, rural and suburban school districts. Nine had a minority population of 50% or more and 18 drew from neighborhoods with household incomes below the median for their state. Eighty-nine per cent of the subjects were enrolled in the 12th grade and 11% had dropped out of school before graduation. Seventy-one per cent classified themselves as white, 8% African American, 9% Hispanic, 9% Asian and the rest multi-ethnic or American Indian. Therefore, we have sufficient subgroup sample sizes to estimate differences in alcohol misuse across racial/ethnic groups. In this study, we focus on the first four groups.

Because these respondents were all participants in a multi-year drug prevention experiment, we tested for differences in prevalence estimates between treatment and control students, and found no treatment effect. Earlier analyses also indicated that the prevention program had no impact on drinking in high school (Ellickson, Bell & McGuigan, 1993a). Accordingly, we present results for the entire sample here.

During fielding of the grade 12 survey we tracked and located over 480 high school dropouts, thereby reducing the estimation problems associated with samples based solely on enrolled students (Pirie, Murray & Luepker, 1988). In addition our weighting methods, described below, allow us to account for baseline (7th grade) sample participants who did not return a survey at grade 12 (30%). Thus our prevalence estimates reflect the entire cohort of seventh graders originally enrolled in all 30 schools.

Constructing sample weights

To correct for sample attrition we created non-response weights for each observation. Using logistic regression, we generated predicted probabilities of returning the grade 12 survey that are a function of multiple baseline (7th grade) predictors ($\hat{p} = e^{\sum \beta_i X_i} / 1 + e^{\sum \beta_i X_i}$). These include indicator variables for gender, race/ethnicity and disrupted family structure plus measures of academic ability, deviance, drug-related beliefs and drug use. The weights, which are the reciprocals of these probabilities ($1/\hat{p}$), range from just over 1.08 to 7.60. A student with a predicted probability of responding to the survey of 0.8 has a weight of 1.25, while one with a predicted probability of 0.4 has a weight of 2.5.

This weighting strategy assumes that once we control for the predictors in the logistic regression model, the non-respondents are missing at random (Little & Rubin, 1987). As documented below, this approach reduces bias attributable to non-response, but can result in larger variance estimates and thus more conservative hypothesis tests.

Validation on baseline (7th grade) variables showed that the weights removed 90% or more of the bias due to non-response at grade 12. For example, we found that the weighted 12th grade sample yields nearly the same estimates of 7th grade marijuana use (19.6%) as does the original group of 7th grade respondents (20.1%). In contrast, the figure unadjusted for non-response (14.6%) would sharply understate the actual prevalence of marijuana use in the baseline sample. Similar results were obtained for a variety of other 7th grade items including gender, grades and use of alcohol and cigarettes. However, the weights cannot correct for any additional non-response bias in 12th grade variables that is not associated with the baseline predictors that we used.

Additional analyses showed that these weights also work well for gender subgroups. For different racial/ethnic groups, however, they are differentially effective, sometimes failing to eliminate all of the non-response bias or overcompensating substantially. Hence we constructed four additional weights for racial/ethnic comparisons, using separate logistic regressions for each group (white, Hispanic, African American and Asian).

Reliability of the data

The 12th grade survey, which was self-administered and required informed consent for participation, asked respondents about their alcohol use and related behavior. Earlier analyses of self-reports from this sample indicated that the great majority provided reliable information about their drinking behavior and use of other drugs. Across four waves of data the proportion of students who denied using alcohol, cigarettes or marijuana after previously admitting use averaged about 5% (Reinisch, Bell & Ellickson, 1991). Similarly, 95% of students with cotinine scores that identified them as recent tobacco users admitted to recent use of cigarettes or

chewing tobacco (Freier, Bell & Ellickson, 1991).

Constructing indicators of alcohol misuse

Because the field of alcohol research lacks consensus about what constitutes alcohol misuse or problem drinking among young people, we examined several dimensions of alcohol misuse—high-risk patterns of drinking, drinking that results in negative consequences, and quantity/frequency measures. Examining these three dimensions involved several steps: (1) obtaining expert opinions about what constitutes misuse for adolescents of different ages; (2) using that information, combined with empirical analyses, to construct a series of binary indicators of misuse and to assess the interrelationships among the three dimensions (high-risk drinking, problems from drinking, and overall consumption) for each set of binary indicators; and (3) developing indices of the number of problems from drinking and different high-risk drinking behaviors.

We asked 10 experts to designate the level of use that constitutes misuse for each of 25 items about drinking behavior contained in the 12th grade and earlier surveys (Hays & Ellickson, 1996). We also asked them to suggest what combinations of items they would use to construct overall misuse indices. The results showed considerable variability, particularly for questions about frequency of use (in past year, past month, etc.), quantity of use and quantity/frequency indices (QFI). However, most of the experts felt that frequency and quantity should be considered together. Most also made significant distinctions between the quantity/frequency levels that constituted misuse for younger versus older adolescents. Hence we evaluated several QFI indicators, two with different cut-off points (QFI >0.30 or >0.50 drinks per day in the past month) and a combination measure that included daily drinking *or* drinking four or more drinks per occasion *or* drinking two or three times a month and three or more drinks per occasion (Binge QFI).

For high-risk drinking behavior and problems from drinking the panel showed considerably more consensus, generally agreeing that experiencing most problems or high-risk behaviors once or twice in the past year constituted misuse. However, several experts advocated higher cut-offs for different items or consideration of different *types* of problems or high-risk drinking and these opinions are reflected in the indicators for persistent misuse and multiple types of misuse (variety).

Indicators of alcohol misuse

Based on the experts' opinions plus data from sample prevalence rates, we constructed four different definitions for each of the three dimensions of misuse—high-risk drinking, problems from drinking and quantity/frequency (or high consumption). Appendix I summarizes the high-risk and problem items used in the analysis and provides details on how each item contributed to the misuse indicators listed under each of four definitions.

The *most inclusive* indicators (definition 1) reflect the modal opinion of the experts that any high-risk drinking or drinking-related problem in the past year constitutes alcohol misuse for most of the items. The high consumption measure in this series (QFI >0.30 or an average of 2.1 or more drinks per week) is slightly higher than the expert's modal choice for grades 9–11. For the "any misuse" variables in Fig. 1, subjects are given a score of one (vs. zero) if they have a positive score on any of the three dimensions included under each definition—high-risk drinking, problems from drinking or high consumption.

A second and third set of indicators (definitions 2 and 3) capture either *persistent misuse* (multiple instances of specific alcohol-related problems or types of high-risk drinking) or *multiple types of misuse* (three or more different types of alcohol-related problems or high-risk drinking), reflecting the opinion of some experts that persistence and variety are important. The persistence criteria take into account both the frequency rates for high-risk drinking and alcohol-related problems in this sample and the variability in expert opinions about the levels of persistence that constitute misuse. These criteria typically involve at least three instances in the last year and range from any occurrence (e.g. driving after drinking, having an accident after drinking) to 10 or more times (being drunk or intoxicated). For the high consumption index in definition 2, we used the binge QFI indicator described above; for that index in definition 3, the quantity/frequency measure is the average of

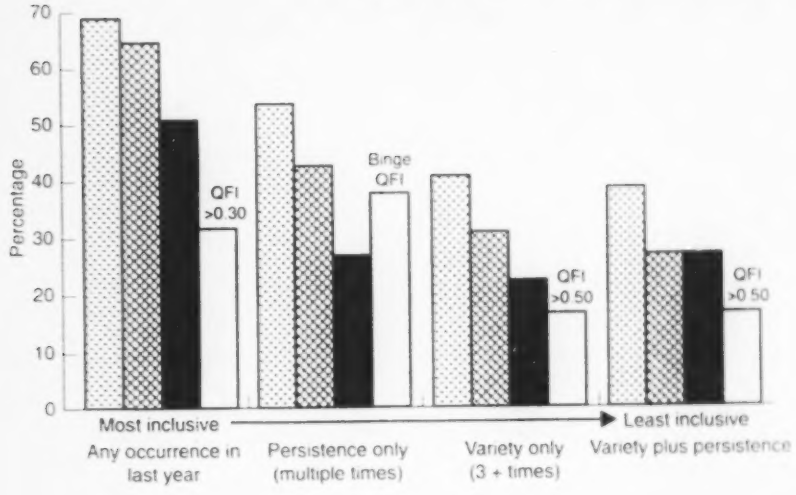

Figure 1. *Teenage alcohol misuse is high by any definition (high school seniors and dropouts, weighted estimates, n = 4390).* □ = *any misuse;* ■ = *high risk drinking;* ■ = *problems from drinking;* ▒ = *high consumption (QFI).*

the experts' modal choice for older teenagers (QFI > 0.50 or 3.5 drinks/week).

The *least inclusive* definition combines variety and persistence criteria. Because high-risk drinking is quite common in our sample, we required that subjects engage in two or more *types* of high-risk behavior to be counted as high-risk drinkers. For persistence and high consumption, we used the most stringent criteria from previous definitions (multiple instances of most alcohol-related problems and high-risk drinking behaviors, QFI > 0.50).

Analytic method

For the analyses presented below, we developed weighted estimates for different measures of alcohol misuse across gender and ethnic groups, examined correlations and cross-tabulations among the different measures, and assessed whether differences across groups hold up in multivariate (logistic) equations that control for socio-economic status and other background factors.

The initial logistic regressions controlled for 17 variables, including race/ethnicity (dummy variable indicators for Hispanic, African American, Asian, and American Indian or other ethnicity), income adjusted for the square root of household size (in $1000 units), dummy variables for the two higher tertiles of a socio-economic status (SES) measure that combines parental education and occupation, a dummy variable that indicated for which cases we imputed the SES values (Raymond, 1986), gender, disrupted (i.e. non-nuclear) family, age, treatment and various interaction terms for gender and ethnicity. We assessed the results for each of the eight dependent variables contained in the most and least inclusive definitions of alcohol misuse, ultimately choosing the same scaled-down model for each dependent variable. Huber's formula (1981) was used to obtain standard errors appropriate for these weighted analyses.

Our final multivariate model contained binary indicators for the racial/ethnic groups noted above (with whites as the referent group), the two upper SES tertiles, being female, and coming from a disrupted family. We also included one continuous variable, adjusted income, and an interaction term for the combination of being both female and Hispanic. Age, the imputation dummy variable and the other interaction terms for ethnicity and gender were not significant in any of the eight equations. Differences between

Table 1. *Prevalence of adolescent drinking problems and high-risk drinking behaviors (high school seniors and dropouts, weighted estimates, % of all drinkers)*

	All Drinkers	Males	Females	Whites	Hispanics	African Americans	Asians
Problems from drinking							
Missed school or work	15.5	16.4[a]	14.5[a]	16.0[a]	18.2[a]	12.2[a,b]	9.0[b]
Felt sorry	38.3	39.1[a]	37.5[a]	40.5[a]	36.4[a,b]	30.2[b,c]	29.5[c]
Felt really sick	51.7	53.1[a]	50.2[a]	54.4[a]	49.6[a,b]	42.0[b]	41.1[b]
Got in a fight	17.1	22.2[a]	11.5[b]	16.9[a]	20.2[a]	18.0[a]	9.2[b]
Got in trouble at home or school	18.2	20.5[a]	15.8[b]	18.7[a]	17.9[a,b]	18.0[a,b]	12.6[b]
Got arrested	7.3	9.4[a]	5.1[b]	6.7[a]	8.1[a]	10.3[a]	4.6[a]
Had accident after drinking	6.9	7.8[a]	5.9[b]	6.8[a]	8.0[a]	7.3[a]	5.6[a]
Passed out	30.2	31.8[a]	28.5[b]	32.1[a]	27.6[a,b]	20.1[b]	20.7[b]
Type of high-risk drinking							
Binge drinking	49.1	55.4[a]	42.5[b]	50.4[a]	53.8[a]	41.9[b]	36.8[b]
Used alcohol with depressants (e.g. barbiturates)	4.5	5.2[a]	3.7[b]	5.1[a]	6.8[a]	0.6[a]	2.2[b]
Used alcohol with stimulants (e.g. amphetamines)	10.3	10.9[a]	9.6[a]	11.0[b]	15.9[a]	0.9[d]	6.1[c]
Used alcohol with marijuana	35.9	39.9[a]	31.6[b]	35.7[b]	42.2[a]	34.9[a,b,c]	26.3[c]
Drank before or during school	31.2	35.2[a]	26.9[b]	29.8[a,b]	34.7[a,b]	37.9[a]	28.1[b]
Got drunk or intoxicated	64.0	67.2[a]	60.6[b]	67.9[a]	54.8[b]	51.5[b]	52.0[b]
Drove car after drinking	32.1	39.1[a]	24.7[b]	34.3[a]	32.7[a]	21.6[b]	26.8[b]

Male/female differences are significant ($p < 0.05$) when the superscripts (a, b) in the relevant row differ. Similarly, racial/ethnic groups with different superscripts have significantly different rates of misuse. All comparisons base on χ^2 test of statistical significance.

groups were considered significant if the probability was less than or equal to 0.05. Because the number of significant effects overall is inflated by chance, we interpret our results with this in mind. We do not employ a Bonferroni adjustment because this method is too conservative and increases Type II error (Holland & Copenhauer, 1987).

We also tested for design effects that might yield overly liberal tests of significance. Although intracluster (within-school) correlation has no effect on the point estimates of regression coefficients, it can result in standard errors that are downward-biased. Hence we tested for the presence of positive intracluster correlation in alcohol use among students within schools, finding its magnitude to be small (approximately 0.01). Resulting hypothesis tests were not different from those based on models that ignored this effect.

Results

Prevalence of alcohol misuse

As Fig. 1 shows, a substantial proportion of teenagers misuse alcohol by any definition. Nearly 70% of the sample exhibited some form of alcohol misuse within the last year, with 74% of this group meeting at least two of the three criteria for misuse. Two-thirds engaged in high-risk drinking; over 50% suffered one or more alcohol-related problems; and about a third consumed an average of 2.1 drinks per week.

More stringent definitions yield lower estimates of alcohol misuse, but still include about 40% or more of these adolescents. Fifty-four per cent qualify as persistent misusers (definition 2) and 41% have experienced several different types of risky drinking or alcohol-related problems (definition 3). Even under the least inclusive definition, the pool of alcohol misusers comes to nearly 40%.

If a teenager drinks at all, he or she is highly likely to engage in some form of misuse. Eighty-six per cent of the adolescents who had anything to drink in the past year met the liberal (most inclusive) definition of alcohol misuse. Thus, for every teenage drinker who did not misuse, six others did. Almost all of these misusers qualified as high-risk drinkers and three-fourths had suffered one or more negative consequences from drinking, with comparatively fewer (47%) meeting the liberal criterion for high average consumption.

As Table 1 shows, about 80% of the drinkers have experimented with at least one form of risky drinking, the most common being getting drunk or intoxicated (64%), binge drinking (49%), using marijuana with alcohol (36%) and drinking and driving (32%) (see Table 2). Not surprisingly, many of these drinkers have experienced one or more alcohol-related problems because of drinking in the last year. Physiological and emotional consequences—feeling sick, doing something you later felt sorry for and passing out—are the most common, with between 30% and 52% of the drinkers experiencing these problems.

Teenagers who misuse also report doing things that interfere with their social interactions or responsibilities, but these consequences are less common. Between 16 and 18% of the drinkers have missed school or work, got into trouble at school or home or been in a physical fight because of drinking. Far fewer have experienced problems that have actual or potential legal consequences: about 7% have been arrested because of drinking and the same proportion had a motor vehicle accident that involved personal injury or property damage. Adolescents who engage in high-risk drinking patterns are especially likely to experience negative consequences from using alcohol, with 94% of the high-risk drinkers experiencing at least one alcohol-related problem in the last year.

Relationships among types of misuse

Analysis of relationships across the three dimensions supports the conclusion that adolescent misuse of alcohol is more frequently characterized by episodic bouts of high-risk drinking or drinking that has negative consequences than it is by persistent high consumption. Under the most inclusive definition, the Pearson product-moment correlation between high-risk and problem drinking (0.64) is substantially higher than the correlations between these two variables and high consumption (0.48 and 0.49). Almost all the high consumers are also high-risk drinkers, but only 46% of the high-risk drinkers are also high consumers. The same pattern holds for problems from drinking. Almost 90% of the high consumers have also experienced one or more alcohol-related problems, but only 51% of the

Table 2. *Gender and ethnic breakdowns for adolescent alcohol misuse (high school seniors and dropouts, weighted estimates, n = 4390)*

	Most inclusive definition (%)				Least inclusive definition (%)					
	Any alcohol misuse	Any high-risk drinking	Any drinking problems	QFI > 0.30	Any alcohol misuse	high-risk drinking	drinking problems	QFI > 0.50	Average no. of different drinking problems	Average no. of different high-risk drinking behaviors
Male	70.6[a]	66.2[a]	53.5[a]	36.8[a]	45.6[a]	32.1[a]	31.8[a]	21.0[a]	1.40[a]	1.44[a]
Female	68.1[a]	63.3[a]	49.1[b]	25.7[b]	31.9[b]	20.5[b]	21.3[b]	12.3[b]	1.16[a]	1.18[b]
White	73.1[a]	68.5[a]	55.7[a]	34.6[a]	42.4[a]	29.6[a]	29.4[a]	18.2[a]	1.39[a]	1.41[a]
Hispanic	67.7[a]	63.5[a]	51.2[a]	32.3[a]	39.5[a]	25.5[a]	27.9[a]	16.9[a]	1.38[a]	1.41[a]
African American	61.8[b]	56.7[b]	36.9[b]	22.2[b]	29.0[b]	17.4[b]	19.2[b]	14.5[a,b]	0.88[b]	1.00[b]
Asian	49.7[c]	46.6[c]	33.5[b]	18.6[b]	23.4[b]	16.0[b]	15.1[b]	10.4[b]	0.76[b]	0.85[b]

See Appendix I for definitions of alcohol misuse, high risk-risk drinking, and drinking problems.

Male/female differences are significant ($p < 0.05$) when the superscripts (a, b) under the relevant column differ. Similarly, racial/ethnic groups with different superscripts have significantly different rates of misuse. Columns 1–8 comparisons based on χ^2 test of statistical significance; columns 9–10 comparisons based on *F*-tests.

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teenagers with problems are also high consumers. The results are similar when high consumption is defined more stringently. These data indicate that consumption measures fail to include many teenagers who engage in risky drinking or have drinking-related problems.

Do boys misuse more than girls?

In this West Coast sample, teenage girls are nearly as likely as teenage boys to be high-risk drinkers and to have suffered one or more alcohol-related problems. As shown in Table 2, the proportion of females who have engaged in some form of high-risk use and experienced at least one problem from drinking is only 3–4% smaller than that for males. This finding contrasts with other studies, which typically show that men are more likely than women to abuse alcohol, with similar results showing up for adolescents (Huselid & Cooper, 1992; Barnes, Welte & Dintcheff, 1993).

However, gender differences become much more pronounced when we take into account the severity of misuse. Teenage girls are substantially less likely than teenage males to experience the same negative consequence repeatedly or to persistently engage in more than one kind of high-risk drinking (21% vs. 32%). They also exhibit fewer *different* problems or high-risk behaviors and are less likely to meet either liberal or stringent criteria for high average consumption.

With regard to specific forms of high-risk drinking, girls who drink are just as likely as their male counterparts to use alcohol with stimulants (see Table 1). In addition, they are only moderately less likely to have become high or intoxicated in the past year (61% vs. 67%) and to use alcohol with depressants (4% vs. 5%). However, males who drink are considerably more likely than girls to be binge drinkers (56% vs. 43%), to use alcohol before or during school (35% vs. 27%), to use alcohol and marijuana together (40% vs. 32%) and to drive after drinking (39% vs. 25%).

Gender differences are also non-significant for several alcohol-related problems. Similar proportions of female and male drinkers have felt sick because of drinking, missed school or work, or felt sorry for something they did under the influence. As one might expect, however, larger differences show up for consequences that are linked with aggressive behavior. Male drinkers are twice as likely as females to get into fights or to be arrested because of drinking. They are also significantly more likely to have got into trouble at home or school, to have had an accident after drinking and to have passed out.

Ethnic differences in alcohol misuse

Weighted estimates for specific ethnic/racial groups support the findings of earlier studies, that white and Hispanic adolescents typically show significantly higher rates of alcohol use and abuse than Asians and African Americans (Welte & Barnes, 1987; Bachman *et al.*, 1991). As Table 2 shows, white and Hispanic teenagers have similar drinking patterns, as do African American and Asian teenagers. The former are much more likely to misuse alcohol than the latter.

Differences between whites and Hispanics and between African Americans and Asians are generally not significant. However, Asian adolescents are substantially less likely than African Americans to be risky drinkers. Indeed, the largest difference between any two groups shows up for high-risk drinking, with the prevalence rate for whites being 20 percentage points higher than that for Asians.

White adolescents who drink have the dubious distinction of ranking at the top for most types of high-risk drinking (all three forms of polydrug use, drinking before or during school and drinking and driving). In contrast, they take the number one spot for only three of eight problems—feeling sick, passing out and regretting something you did while drinking (see Table 1). African American and Hispanic youth, on the other hand, rank first or second for several of the more serious problems—being arrested, having an accident because of drinking and getting in a fight. These results suggest that African American teenagers who drink are just as likely to suffer severe consequences from alcohol misuse as white teenagers, despite the fact that they are substantially less likely to be high-risk drinkers.

Results from the multivariate models

The multivariate models, which present the logistic results for the four dichotomous variables involved in the most inclusive definition of misuse, confirm the racial/ethnic and gender differences discussed above (see Table 3). Even when we control for socio-economic and other back-

ground factors, African American and Asian youth are significantly less likely than white youth to misuse alcohol, whereas the rates for Hispanic youth are not significantly different from those for whites. Females are significantly less likely than males to have alcohol-related problems and to be high consumers. These results generally mirror those for the least inclusive definition (not shown).

As Table 3 also shows, the key socio-economic variables have opposite effects on alcohol misuse. Teenagers from families with higher incomes are more likely to misuse alcohol; those from families with the highest socio-economic status (occupational/educational) are less likely to do so. Teenagers from broken families are about one-and-a-half times more likely to misuse alcohol than those who live with both biological parents. Indeed, the impact of this variable is stronger than that for any other binary indicator. Moreover, the effect of family disruption on alcohol misuse appears to be long-lasting. The great majority of teenagers from broken families had not lived with both biological parents since grade 7 or earlier; only 12% had experienced a change in family structure by death, divorce or separation in the previous 2 years.

Discussion

Analyses of drinking patterns among high school seniors and dropouts from eight highly diverse West Coast communities suggest that teenage alcohol misuse is a major problem in the United States. Nearly 70% of this group have exhibited some form of misuse within the past year, with over two-thirds engaging in high-risk drinking and over 50% suffering one or more alcohol-related problems. More stringent definitions that require variety or persistence of risky drinking and/or alcohol-related negative consequences still capture between 40% and 54% of this population, a result that echoes earlier work finding that 55% of grade 12 students in selected Michigan schools reported two or more instances of alcohol misuse in the last year (Shope, Copeland & Dielman, 1984).

These statistics, which have been carefully adjusted to account for attrition from school dropouts and other sources of non-response, emphasize the "normative" nature of alcohol misuse. They also give cause for alarm. Alcohol abuse and dependence cost the United States an estimated $98 billion in health care and productivity losses in 1990 (Rice, 1993). Alcohol-related accidents are a major source of drinking-related mortality and morbidity and teenage youth are particularly vulnerable to these consequences of drinking. Older teenagers (aged 16–21 years) account for only 13% of all licensed drivers, but they are responsible for about 25% of all alcohol-related fatal motor vehicle accidents (Phelps, 1988). Teenage drinking also plays a role in many other accidents and increases the risk of suicide, violent behavior, high-risk sex and emotional problems (US Department of Transportation, 1989; Strunin & Hingson, 1992; Ellickson *et al.*, 1993b; Windle, 1994). This study shows that large numbers of adolescents—females, as well as males, and youth from different racial or ethnic groups—put themselves at risk for suffering these and other alcohol-related problems.

The study also shows that definitions of misuse based solely on how much and how often the teenager drinks fail to capture as many as half of these at-risk misusers. Hence studies of alcohol misuse among teenagers need to take into account *multiple dimensions* of misuse (high-risk drinking, problem-related drinking and high consumption). They also need to tap episodic patterns of alcohol use (infrequent binge drinking, drinking before or during school or work) that do not necessarily cause problems for adults. Differences in body weight, experience with alcohol and judgement all make teenagers more vulnerable than adults to many problems associated with episodic drinking (e.g. engaging in unprotected sex, getting into fights, crashing a car).

The lack of consensus among experts about what constitutes adolescent misuse of alcohol underscores the need for multiple measures and bounded estimates (Hays & Ellickson, 1996). Indeed, the literature on alcohol misuse among adolescents in the United States shows noteworthy disagreement on how to define it (Dunn, Glascoff & Knight, 1993). Studies vary in the type of items included, in cut-offs defining different forms of misuse and in the variety of misuse indicators required. Because of this variability, it is difficult to pinpoint precisely how many adolescents misuse alcohol. As this study has done, however, we can and should provide upper and lower bound estimates for different forms of misuse.

Table 3. *Demographic predictors of alcohol misuse (logistic regressions, high school seniors and dropouts)*

	Dependent variables odds ratio for:							
	Any high-risk drinking (n = 3780)		Any alcohol-related problems (n = 3791)		QFI < 0.30 (n = 3956)		Any misuse (n = 3763)	
	OR	95% CL	OR	95% CL	OR	95% CL	OR	95% CL
Hispanic	—		—		—		—	
African American	0.61	(0.45, 0.81)	0.43	(0.32, 0.58)	0.51	(0.37, 0.72)	0.57	(0.42, 0.77)
Asian	0.45	(0.36, 0.57)	0.46	(0.36, 0.59)	0.46	(0.34, 0.61)	0.41	(0.33, 0.52)
Indian	—		—		—		—	
Other ethnic	—		—		—		—	
Adj. income[a]	1.010	(1.006, 1.014)	1.007	(1.003, 1.010)	1.008	(1.004, 1.012)	1.009	(1.005, 1.013
Status 2[b]	—		—		—		—	
Status 3[b]	0.67	(0.54, 0.83)	0.81	(0.67, 0.99)	0.75	(0.61, 0.93)	0.72	(0.58, 0.89)
Imputed variable[c]	—		—		—		—	
Female	—		0.85	(0.74, 0.98)	0.59	(0.51, 0.69)	—	
Female × hispanic	—		0.60	(0.37, 0.97)	—		0.56	(0.34, 0.94)
Disrupted family[d]	1.75	(1.50, 2.04)	1.57	(1.36, 1.82)	1.41	(1.21, 1.65)	1.73	(1.47, 2.03)

Where the odds ratio is shown, the variable is significant at 0.05 or lower, a dash (—) means the variable is not significant.

[a]Adjusted income is household income divided by the square root of family size (in $1000 units).

[b]Status 2 and 3 are binary indicators for the upper two tertiles of a parental status measure that is based on taking the highest eduction and occupational scores (when data for both parents was available), converting to standardized scores, and averaging the two.

[c]The imputed variable marks cases for which parental occupation/education was imputed.

[d]Disrupted family means the adolescent does not live with both biological parents.

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The high rates of problematic alcohol use documented in this study provide strong support for prevention programming that targets alcohol misuse, not simply alcohol onset or experimentation. Such programs should pay particular attention to the most prevalent forms of high-risk drinking—polydrug use, drinking and driving and binge drinking. About one of three teenage drinkers has combined alcohol with marijuana, a mix that exacerbates the effects of alcohol. A similar proportion has driven a car after drinking, and nearly 50% has had five or more drinks in one sitting. Support for targeting alcohol misuse in school-based prevention comes from a program that successfully mitigated alcohol-related problems among adolescents who had previously engaged in unsupervised drinking (Shope *et al.*, 1992).

Social policies that decrease access to alcohol and sanction high-risk behaviors such as drinking and driving also have an important role to play in curbing alcohol misuse. Higher prices for beer have been linked with less frequent beer consumption among young people, especially the heavier drinkers (Coate & Grossman, 1988). Raising the minimum legal drinking age has reduced alcohol-related fatal driving accidents among youth under 21 (O'Malley & Wagenaar, 1991). A concerted effort to increase societal norms and sanctions against other forms of high-risk drinking is needed.

All young people should receive these prevention messages. However, our results also suggest that universalistic programs should be sensitive to gender and racial/ethnic differences in drinking patterns and problems. Teenage girls and boys both exhibit high rates of alcohol misuse, but males are more likely to be persistent misusers, to exhibit a variety of high-risk drinking behaviors and alcohol-related problems and to drink at high consumption rates. Hence prevention programs need to find ways to uncouple drinking from normative expectations about how much, how often, and how recklessly males should and do drink. They also need to help females recognize that they are nearly as vulnerable as males to many problems: lower levels of consumption or persistent misuse do not let them off the hook. We also note that this study did not include an exhaustive list of alcohol-related problems. Hence we may have failed to uncover other gender differences, such as sexual victimization related to alcohol use.

Although African American teenagers are significantly less likely than whites and Hispanics to be high-risk drinkers, they are just as likely to suffer serious problems from drinking. They have slightly higher arrest rates (though not significantly so) and about equal chances of having an accident after drinking, getting into a fight, or getting into trouble at school or home. This suggests that prevention programs should help African American youth understand that they are vulnerable to alcohol-related problems even when they do less high-risk drinking than peers from other ethnic groups.

The counteracting effects of household income and parental education and occupational status on alcohol misuse underline the inadvisability of equating different measures of socio-economic status with each other and of assuming that they have similar impacts on behavior. The link between alcohol misuse and higher income supports the income hypothesis—that people with more money to spend on alcohol consume more of it more frequently (Johnson *et al.*, 1977; Treno, Parker & Holder, 1993). Teenagers from higher income families either have access to more alcohol in the home or more money with which to obtain it. Consistent with the latter interpretation, we found that students' personal income from work was positively associated with binge drinking, controlling for household income and other socio-economic and background variables (data not shown). In contrast, teenagers whose parents have high educational and occupational status may be exposed to higher parental expectations and, therefore, greater parental disapproval for behavior that might interfere with fulfilling those expectations. Indeed, parents with higher education and occupational status were reported by students to be significantly more likely to disapprove of alcohol use ($r = 0.08$, $p < 0.05$). Where high income and high status intersect, therefore, these two variables will tend to offset each other. The same effect occurs for teenagers from low income, low SES families.

Counteracting the impact of family disruption on subsequent alcohol misuse is considerably more difficult. This background characteristic is consistently associated with higher misuse, no matter what the definition. Moreover, its effects appear to be long-term: most of the teenagers from disrupted families experienced the disruption by grade 7 or earlier. Given the long-term

increase in the proportion of children with divorced parents or single parents who never married, the prospects for mitigating this relationship through a reduction in family disruption are small. Nor can we say whether acquiring a step-parent diminishes or increases the impact of family disruption. Our measure of family disruption includes some adolescents who live with a step-parent (or someone who may play that role). Although exploratory analyses indicated that teenagers with step-parents were more similar in behavior to those living in single-parent households, the number is too small to support separate estimates. Hence we believe a more likely strategy involves helping the parent(s) develop a more supportive relationship with the child (Werner & Smith, 1982; Rutter, 1985).

The question arises as to how good our estimates of alcohol misuse actually are. As noted above, the vast majority of adolescents gave reliable responses to the survey questions (see also Reinisch *et al.*, 1991). However, are these estimates likely to sharply understate—or overstate—the prevalence of misuse among high school seniors and dropouts across the United States? Our estimates of fairly common forms of drinking, where the inclusion of dropouts is unlikely to make much of a difference, compare favorably to national estimates for high school seniors and older adolescents during the same year (1990). We find that 51.2% of our sample had become drunk in the past year compared with 52.7% of the seniors included in the 1990 high school senior survey (Johnston *et al.*, 1993a) sponsored by the National Institute on Drug Abuse. Similarly, 78.3% had drunk alcohol in the past year, compared with 80.6% for high school seniors and 77.1% for all youth between ages 18 and 21 years (Johnston *et al.*, 1993a; USDHHS, 1991). For alcohol misuse, our statistics are somewhat higher than those from the national survey of high school seniors (38.6% binge drinkers vs. 32.2%), a result we would expect because our data include dropouts and also adjust for other forms of attrition. Overall, therefore, these comparisons with national data give us confidence that our estimates are close to the mark for all youth in the United States and thus are generalizable to a variety of school and community settings. However, because the data were collected in the United States, the results cannot be generalized to other countries. Additional studies are needed to provide estimates of alcohol misuse internationally.

The high rates of adolescent alcohol misuse documented in this study also point to the need for improving our understanding of the factors that promote it. As others have noted, the etiology of problematic drinking has been given less attention than the etiology of initial use (Newcomb & Bentler, 1989; Smart *et al.*, 1990). Future research needs to identify the risk and protective factors for different types and different degrees of alcohol misuse.

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Appendix I

Indicators of problems from drinking and high risk drinking: (number of indicators and number of times required for each definition of misuse)

	Definition			
	1[a]	2[b]	3[c]	4[d]
Problem or risk item	Most inclusive	Persistence only	Variety only	Least inclusive
High risk drinking	One + behavior	One + behavior	3 + behaviors	Two + behaviors
Past month:				
5 + drinks	1 + times	2 + days	1 + times	2 + days
Past year:				
Drink before/during school	1 + times	3 + times	1 + times	3 + times
Drunk or intoxicated	1 + times	10 + times	1 + times	10 + times
Alcohol + depressants	1 + times	3 + times	1 + times	3 + times
Alcohol + stimulants	1 + times	3 + times	1 + times	3 + times
Alcohol + marijuana	1 + times	3 + times	1 + times	3 + times
Drive after drinking	1 + times	1 + times	1 + times	1 + times
Problems from drinking (past year)	One + problem	One + problem	3 + problems	One + problem
Missed school or work	1 + times	3 + times	1 + times	3 + times
Felt sorry	1 + times	3 + times	1 + times	3 + times
Felt really sick	1 + times	3 + times	1 + times	3 + times
Physical fight	1 + times	1 + times	1 + times	1 + times
Trouble in school	1 + times	3 + times	1 + times	3 + times
Arrested	1 + times	1 + times	1 + times	1 + times
Passed out	1 + times	3 + times	1 + times	3 + times
Accidents after drinking	1 + times	1 + times	1 + times	1 + times
Quantity/frequency	2.1 drinks/week	Binge QFI	3.5 drinks/week	3.5 drinks/week

[a]For the most inclusive classification (definition 1), drinking problems = one or more negative consequences from drinking, at least one time for each event; high risk = one or more high risk behaviors, at least one time for each behavior; QFI > 0.30.

[b]For definition 2, drinking problems = one or more negative consequences, with multiple times for most consequences; high risk drinking = one or more high risk behaviors, with multiple occurrences for most behaviors; binge QFI = daily drinking or four drinks or more on the days that respondent drinks or three drinks or more at least twice a month.

[c]For definition 3, drinking problems = three or more negative consequences (at least one time for each); high risk drinking = three or more high risk behaviors (at least one time for each); QFI > 0.50.

[d]For definition 4, (the least inclusive), drinking problems = one or more negative consequences, with multiple times for most consequences; high risk drinking = two or more high risk behaviors, with multiple occurrences for most behaviors; QFI > 0.50.

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